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MICROSCOPE, ESPECIALLY MICROSCOPE USED FOR INSPECTION IN  
SEMICONDUCTOR MANUFACTURE

The invention is directed to the coupling of pulsed laser radiation into a microscope, especially a microscope used for the quality control and classification of defects of masks for the manufacture of semiconductors.

Advantageously, a number of laser pulses are applied to the object to be examined while one image is taken. During this, intensity modulations of the laser profile of up to 40% can occur within one pulse or over a small number of pulses, which affects the evaluation.

Figure 1 shows an overall diagrammatic view of an inspection device consisting of a laser module LM with a pulsed UV laser, a transmitter port UP, a microscope MI with an objective O and a scanning table ST, a CCD camera KA, a screen BS and a microscope controller MC.

Figure 2a and 2b show a coupling unit UP for coupling the laser beam into the microscope MI.

The laser light reaches a first rotating diffusion disk S1 via reflecting mirrors U1, U2 and then a second rotating diffusion disk S2 preferably rotating in the opposite direction as well as the microscope ray path (not shown) via a lens for beam expansion and an aperture B and the input E in Figure 1 and illuminates the object to be examined.

The laser profile is smoothed out by means of the at least one diffusion disk.

The diffusion disk rotates at a speed which is relatively low when compared to the spacing of two laser pulses.

This means that the diffusion disk is practically not moving for the duration of a laser pulse of, for example, 10ns, but also that it moves a bit further in the space of time between two laser pulses (for a repeating frequency of, for example, 200Hz) before the next laser pulse occurs.

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This has the advantage of averaging out the granularity of the diffusion disk and furthermore that the granularity caused by the coherence of the laser radiation (speckle) is also averaged out.

5 This means that noise is reduced and an the image contrast is increased and that therefore image quality is improved.

For this, the magnitude of the rotating speed of the diffusion disk can lie in the easily realized range of approximately 1 rotation per second (a speed in the range of cm/s), so that for an assumed grain size of 0.1mm a displacement by at least the size of one grain takes place between two pulses.

10 The homogenizing effect is reinforced by a second diffusion disk rotating in the opposite direction.

Besides granulated diffusion disks (made by etching or abrasive blasting), holographic disks can also be used.

15 CGHs (computer-generated holograms) can also be used for homogenization.

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# ABSTRACT

The invention relates to a microscope, especially a microscope that is used for inspection in semiconductor manufacture.. The inventive microscope comprises a pulsed laser for the purpose of illumination, preferably in the UV range. At least one rotating diffusion disk is disposed downstream of the laser so as to homogenize the illumination. Preferably, two rotating diffusion disks of opposite rotational sense are disposed in the illumination beam path either directly or indirectly one behind the other.

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